

KEY WEST HARBOR, FLA.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING,

WITH A LETTER FROM THE ACTING CHIEF OF ENGINEERS,
REPORTS ON PRELIMINARY EXAMINATION AND SURVEY OF
KEY WEST HARBOR, FLA., WITH A VIEW TO CONSTRUCTION OF
A HARBOR OF REFUGE AND A SAFE ANCHORAGE FOR VES-
SELS.

JANUARY 31, 1914.—Referred to the Committee on Rivers and Harbors and ordered
to be printed, with illustration.

WAR DEPARTMENT,
Washington, January 30, 1914.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

SIR: I have the honor to transmit, herewith, a letter from the
Acting Chief of Engineers, United States Army, dated 29th instant,
together with copies of reports from Maj. J. R. Slattery, Corps of
Engineers, dated April 28, and October 9, 1913, with map, on pre-
liminary examination and survey of Key West Harbor, Fla., made
in compliance with the provisions of the river and harbor act approved
March 4, 1913.

Very respectfully,

LINDLEY M. GARRISON,
Secretary of War.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 29, 1914.

From: The Chief of Engineers, United States Army.

To: The Secretary of War.

Subject: Preliminary examination and survey of Key West Harbor, Fla.

1. There are submitted herewith, for transmission to Congress, reports dated April 28 and October 9, 1913, with map, by Maj. J. R. Slattery, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the following item contained in the river and harbor act approved March 4, 1913: Key West, Fla., for a harbor of refuge and a safe anchorage for vessels.

2. The existing project for improvement of Key West Harbor is to deepen and widen the main ship channel at the entrance and at Triangle Shoals, so as to afford a channel 30 feet deep and 300 feet wide at mean low water; to remove the shoals in the anchorage and to maintain a channel 17 feet deep and of sufficient width through the northwest passage. The district officer reports that, so far as commerce is concerned, Man of War Harbor would apparently provide about all that is needed in this locality in the way of a harbor of refuge for commercial vessels. It appears, however, that the Navy Department desires the construction of a protected basin for torpedo boats and other small craft, and, based on plans outlined by that department, the district officer submits an estimate in the sum of \$300,000 for construction of breakwaters required for this purpose. He also submits an estimate for a harbor which would provide adequately for both naval and commercial purposes, amounting to \$2,138,262, which estimate may be reduced to \$1,550,450 by omission of arm D, shown on accompanying map. He is of opinion that the larger plan, adapted for both military and commercial use, is not worthy of being undertaken by the United States, and concerning the construction of the smaller basin proposed by the Navy, he makes no recommendation. The division engineer concurs in general with the views of the district officer, believing that the question of whether a sheltered harbor is needed for the smaller class of naval vessels is one which should be left to the Navy Department.

3. These reports have been referred, as required by law, to the Board of Engineers for Rivers and Harbors, and attention is invited to its report herewith, dated December 16, 1913. The board concurs with the district officer and the division engineer in the opinion that the United States would not be justified in providing a harbor of refuge at this locality in the interests of commerce and navigation; but should Congress decide that the needs of the United States for the protection of its vessels and property are sufficient to justify the expense, it recommends that the Chief of Engineers be directed to prepare and execute a project for a sheltered harbor for the smaller craft of the Treasury, War, and Navy Departments, acceptable to them, and at a cost approximately that stated.

4. After due consideration of these reports, I concur with the views of the Board of Engineers for Rivers and Harbors as expressed above.

EDW. BURR,
*Colonel, Corps of Engineers,
Acting Chief of Engineers.*

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS
ON SURVEY.

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
December 16, 1913.

To the CHIEF OF ENGINEERS, UNITED STATES ARMY.

1. This report covers preliminary examination and survey of Key West, Fla., for a harbor of refuge and a safe anchorage for vessels. The existing project for this harbor provides for an entrance channel from the south 300 feet wide at mean low water and 30 feet deep, the removal of the shoals in the anchorage, and the maintenance of a channel 17 feet deep and of sufficient width through the northwest passage. This project is practically completed.

2. Man of War Harbor, located in the northern part of Key West Harbor, affords a commodious anchorage and refuge for vessels of from 18 to 25 foot draft. The commercial docks generally lie to the south of Man of War Harbor. During violent southerly storms vessels can not lie at these docks, but must seek shelter in Man of War Harbor. The naval station lies between the commercial docks and Fort Taylor. Except for very small vessels, this portion of the harbor affords shelter from northerly winds, but is not a safe anchorage during southerly storms.

3. The commerce of Key West as given by the Key West Board of Trade amounts to 227,660 tons for the year 1912.

4. With reference to a harbor of refuge, Man of War Harbor would apparently provide about all the shelter that is needed for commercial purposes, but this shelter could be greatly extended by means of suitable breakwaters at some point near Fort Taylor and on the opposite side of the harbor. There has been no demand, however, for the creation of a harbor of refuge on the part of commercial steamship lines. It appears that this investigation was proposed by the Navy Department, which desires a protected harbor for torpedo boats and other small craft. A plan is suggested by the Navy Department for such a harbor, which would afford a sheltered area of about 47 acres. This would not, however, add anything to the harbor from a commercial point of view.

5. The district officer states in the report on preliminary examination that if a sheltered area in the immediate vicinity of the navigation station is essential for military purposes, the work necessary to provide for this harbor should be so designed as to improve the harbor as much as possible for commercial purposes also. In his report on survey he submits estimates for the small harbor proposed by the Navy Department in the sum of \$300,000. He also submits estimates for a harbor which would provide adequately for both naval and commercial purposes, as shown on accompanying tracing. Such a harbor is estimated to cost \$2,138,262. Arm D might be omitted so far as hurricanes are concerned, and this would reduce the cost to \$1,550,450.

6. The district officer states that the cost of a harbor designed to afford protection for general commerce and for naval purposes is not believed to be warranted by the commercial or military importance of Key West, and therefore the larger plan suggested is not deemed worthy of being undertaken by the United States. As the

smaller basin would be apparently a naval matter, he expresses no recommendation in regard thereto. The division engineer agrees with the district officer that the commerce of Key West is not sufficient to warrant the construction of an extensive harbor of refuge, and he believes that the question of whether a sheltered harbor is needed for the smaller class of naval vessels is one which should be left to the Navy Department.

7. Interested parties were advised of the unfavorable report of the district officer and given an opportunity of submitting their views to the board. No communications bearing upon this subject have been received, but on December 3, 1913, Hon. D. U. Fletcher, United States Senate, appeared before the board with reference thereto.

8. From a study of all the information now available, it appears clear to the board that there is no urgent demand or necessity for a harbor of refuge at this locality in the interests of commerce and general navigation, and that the United States would not be justified in providing such a harbor for the benefit of these interests. It appears that the plan suggested by the Navy Department for a small harbor may affect the interests of the War and Treasury Departments, which also occupy adjacent property. Should the Congress decide that the needs of the United States for the protection of its vessels and property are sufficient to justify the expense, the board would recommend that the Chief of Engineers be directed to prepare and execute a project for a sheltered harbor for the smaller craft of the Treasury, War, and Navy Departments acceptable to them, and at a cost approximately that named.

9. In compliance with law, the board reports that there are no questions of terminal facilities, water power, or other subjects so related to the project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the board:

W. M. BLACK,
Colonel, Corps of Engineers,
Senior Member of the Board.

PRELIMINARY EXAMINATION OF KEY WEST HARBOR, FLA.

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
Jacksonville, Fla., April 28, 1913.

From: The District Engineer Officer.

To: The Chief of Engineers, United States Army
(Through the Division Engineer).

Subject: Report on preliminary examination of Key West Harbor, Fla.

1. In compliance with department letter dated March 18, 1913, I submit the following report on the preliminary examination of Key West Harbor, with a view to construction there of a harbor of refuge and a safe anchorage for vessels, authorized by the river and harbor act approved March 4, 1913.

2. There is submitted herewith a tracing ¹ of the latest coast chart of Key West Harbor.

3. The harbor consists of a pocket in the reef to which there are eight channels of approach. These channels are described in the United States Coast Pilot and likewise on pages 5 and 6 of House Document No. 706, Sixty-second Congress, second session.

4. The river and harbor act of July 25, 1912, adopted a project for deepening and widening the main ship channel at the entrance and at Triangle Shoals, so as to afford a channel 30 feet deep and 300 feet wide, and for removing certain shoals in the outer anchorage. Work is now in progress under this project, and the 30-foot channel will probably be completed by the last of the year. The northwest channel affords a depth of 17 feet and a width of 200 feet.

5. The inner or northern part of the harbor is called Man of War Harbor and is about 2,300 yards long and 400 yards wide, with an area of approximately 181 acres. Even in hurricanes it affords a safe anchorage for vessels drawing 22 feet everywhere except in the extreme northern portion, where there is a safe anchorage for vessels drawing 18 feet. In many places there are safe anchorages for vessels drawing 25 feet.

6. The commercial docks—except that of the Florida East Coast Railroad—lie to the south of Man of War Harbor. The harbor in front of these wharves varies in width from about 200 to 300 yards and affords depths of from 23 to 32 feet. The length of this portion is about 900 yards, and the area is approximately 47 acres. During violent storms from the southeast, south, or southwest ships would not be able to lie at the docks in this portion of the harbor, but would have to seek shelter in Man of War Harbor.

7. The naval station fronts on that portion of the harbor lying between the portion just described and Fort Taylor. This portion of the harbor affords a safe anchorage for vessels drawing not more than 25 feet, except very small vessels, during northeasters, northers, and northwesters, but is not a safe anchorage during storms from the southeast, south, or southwest. Its area is approximately 123 acres.

8. The areas described above may be considered as forming the harbor of Key West, although there are anchorages, more or less protected under most weather conditions, outside of these limits.

9. Previous preliminary examinations and surveys of this harbor have been made as follows:

Section covered.	Congressional documents.				Annual Reports of Chief of Engineers.	
	House or Senate.	No.	Congress.	Session.	Year.	Page.
Northwest entrance.....					² 1868	521
Harbor and Northwest entrance.....	Senate....	³ 11	47th.....	First.....	1882	1314-1316
Northwest entrance.....					⁴ 1887	1221-1234
Ship Channel ²	House....	567	58th.....	Second....	1904	1738-1748
Harbor.....	do.....	² 970	60th.....	First.....		

¹ Not printed.

² No maps.

³ Executive document.

⁴ Contains maps.

10. The commerce of the port for 1911, as given by the Key West Board of Trade, amounted to 764,775 short tons. The commerce for the year 1912, as given by the Key West Board of Trade, is as follows:

Articles.	Unit.	Short tons.	Value.
Brick.....	Thousand.....	10,000	\$70,000
Canned goods.....	Cases.....	6,000	650,000
Cattle.....	Head.....	1,400	15,750
Cement.....	Barrels.....	60,000	450,000
Cigars.....	Cases.....	.....	1,000,000
Coal.....	Tons.....	91,600	548,800
Sash, doors, etc.....	.....	330	8,250
Dry goods.....	Cases.....	3,000	912,000
Fertilizer.....	Sacks.....	30	3,000
Fish.....	Barrels.....	720	72,000
Flour.....	do.....	1,200	73,000
Grain.....	Sacks.....	2,100	66,000
Fruits.....	Crates.....	1,300	65,000
Groceries (fancy).....	Cases.....	.....	500,000
Gasoline.....	Barrels.....	.....	20,000
Hay.....	Bundles.....	880	24,600
Lumber.....	1,000 feet B. M.....	34,000	230,000
Meats (fresh and salt).....	Boxes.....	.....	370,000
Machinery.....	Tons.....	.....	500,000
Miscellaneous merchandise.....	Cases.....	.....	2,500,000
Naval stores.....	Barrels.....	.....	50,000
Pineapples.....	Crates (302,000)....	15,100	500,000
Sponges.....	Strings.....	.....	500,000
Wood (fuel).....	.....	.....	50,000
Total.....	.....	227,660	9,178,400

11. As the work on the Florida East Coast Railroad is completed the amount of local freight will probably be still further reduced.

12. The following is a list and description of the commercial steamers calling regularly at Key West:

Name of boat.	Name of line.	Port.	Draft-loaded.	Net tonnage.	Trips.	
					Per week.	Per year.
Olivette.....	Peninsular and Occidental Steamship Co.	Tampa and Habana.....	13	1,026	2	80
Mascotte.....	do.....	do.....	13	520	2	120
Miami.....	do.....	Habana.....	13	1,311	3	98
Governor Cobb.....	do.....	do.....	17	1,556	3	45
Halifax.....	do.....	do.....	18	1,058	3	42
Julian Alonzo.....	do.....	do.....	13	460	2	14
Evangeline.....	do.....	do.....	18	3,448	3	7
Concho ¹	Mallory Steamship Co...	Plying between New York, Key West, Tampa, Galveston, and Mobile.	20	2,640	.....	15
Nueces ¹	do.....	do.....	20	2,465	.....	15
Alamo ¹	do.....	do.....	20	2,236	.....	15
Colorado ¹	do.....	do.....	20	2,022	.....	15
Sabine ¹	do.....	do.....	20	2,478	.....	15
Denver ¹	do.....	do.....	20	2,819	.....	15
Lampasas ¹	do.....	do.....	20	2,236	.....	15
Rio Grande ¹	do.....	do.....	20	2,047	.....	15
San Marcos ¹	do.....	do.....	20	2,187	.....	15
San Jacinto ¹	do.....	do.....	20	3,870	.....	15
Dr. Lykes.....	.....	Key West.....	.....	75	.....	52
Mildred.....	Towles Line.....	Fort Myers, Punta Gorda, Tampa, and Key West.	12	217	.....	52

¹ These ships call at Key West four times each trip.

13. The following is a list and description of United States naval vessels arriving and departing during the year 1912:

Name of vessel.	Normal displace- ment.	Mean draft, loaded.	Number of calls dur- ing year.
	<i>Tons.</i>	<i>Ft. in.</i>	
Collier Arethusa.....	6,159	20 11	3
Collier Ajax.....	9,250	24 8	1
Collier Brutus.....	6,600	23 1	2
Collier Mars.....	11,230	24 8	1
Collier Hector.....	11,230	24 8	1
Collier Sterling.....	5,663	22 6	2
Tug Osceola.....	571	14	1
Tug Patapsco.....	775	12 3	2
Tug Patuxent.....	775	12 3	2
Tug Peoria.....	487	10 6	1
Tug Massasoit.....	202	8 6	1
Tug Uncas.....	441	12	1
U. S. S. Montgomery.....	2,072	14 6	1
U. S. S. Petrel.....	890	11 6	1
U. S. S. Nashville.....	1,371	11	1
U. S. S. Birmingham.....	3,750	16 9	1
U. S. S. Des Moines.....	3,200	15 9	1
U. S. S. Ammen.....	742	8 4	1
U. S. S. Burrows.....	742	8 4	1
U. S. S. Flusser.....	700	8	1
U. S. S. Lamson.....	700	8	1
U. S. S. Mayrant.....	742	8 4	1
U. S. S. Monaghan.....	742	8 4	1
U. S. S. Preston.....	700	8	1
U. S. S. Smith.....	700	8	1
U. S. S. Patterson.....	742	8 4	1
U. S. S. Perkins.....	742	8 4	1
U. S. S. Trippe.....	742	8 4	1
U. S. S. Walke.....	742	8 4	1
U. S. S. Reid.....	700	8	2
U. S. S. Sterrett.....	742	8 4	1
U. S. S. Mackenzie.....	65	4 3	1

14. During the year 1912, 1,504 ships westbound signaled the Sand Key Station, and 407 eastbound. As only a small portion of eastbound ships signal this station, the actual number passing was probably in the vicinity of 3,000 vessels.

15. Since the completion of the Florida East Coast Railroad to Key West, a large passenger business has developed through this port, and it is stated by railroad officials that a large amount of perishable freight from Cuba is moving through this port. Early in the present year the Peninsular & Occidental Steamship Co. established steamer service between Colon, Panama, and Key West. There is a daily service between Key West and Habana, and regular weekly service between Key West, New York, and Mobile, and triweekly service between Key West and Tampa.

16. So far as commerce is concerned, Man of War Harbor would apparently provide about all that is needed in this locality in the way of a harbor of refuge, but by means of a breakwater extending out from some point near Fort Taylor and another on the opposite side of the harbor, the portion of the basin in the vicinity of the commercial docks, as well as that portion in front of the naval reservation, could be protected and made as secure as Man of War Harbor. Almost any desired amount of sheltered area could be added to the harbor by suitable arrangement of the breakwaters.

17. There has been no demand for the creation of a harbor of refuge at Key West on the part of commercial steamship lines. The Navy Department, however, as will be seen from memorandum by Capt. E. E. Hayden, attached hereto, plans to make Key West an

important secondary supply and torpedo-boat base to the principal battleship base at Guantanamo, and with that end in view desires the construction of a large inclosed basin in front of the naval station (such as indicated on map); in which such craft as gunboats, destroyers, and submarines can find shelter from heavy weather while undergoing repair and refitting, or preferably (see par. 4, Capt. Hayden's memorandum), in view of the fact that such an inclosed basin would not be sufficient in itself to protect the numerous, very expensive, important, and delicate naval vessels that might be there in a hurricane, and would not assist the shipping of Key West, which is in vital need of suitable breakwaters, breakwaters projecting southeasterly from Fort Taylor to the end of Whitehead Spit, and continued again beyond the channel in a westerly and northerly direction on Kingfish Shoal and finally easterly on the Middle Ground and Frankford Bank.

18. If a basin were constructed as proposed by the Navy Department, it would provide a sheltered area in front of the naval station of about 47 acres and would probably provide sufficient space for all torpedo craft likely to seek shelter here. It would not add anything, however, to the harbor from a commercial point of view and would not, as pointed out by Capt. Hayden, make provision in the vicinity of the navy yard for a large fleet composed of all classes of naval vessels. Furthermore, it would be next to impossible for vessels to enter the proposed basin under stress of heavy weather from the southeast, south, or southwest. If a sheltered area in the immediate vicinity of the naval station is essential for military purposes in addition to Man of War Harbor, the works necessary to provide this area should be designed so as to also improve the harbor as much as possible from a commercial point of view. The type of breakwater proposed by the Navy Department (vertical concrete) would be very expensive to build, and it is probable that for the same or only slightly greater amount of money rubble-mound breakwaters could be constructed which would provide a much greater sheltered area than would be provided in the proposed naval basin, would provide ample shelter for the needs of the Navy, and would at the same time greatly improve the harbor for commercial purposes and make it, in fact, a harbor of refuge.

19. The local commerce to be benefited would not of itself warrant this improvement at the present time, but taking into consideration the needs of the Navy Department, and the great number of ships passing near this harbor, the locality is believed to be worthy of improvement to the extent of constructing such breakwaters as will provide shelter for the anchorage lying in front of the naval station and Fort Taylor, and such additional area as can be protected, without giving undue length to the breakwaters or greatly exceeding the cost of such work as proposed by the Navy Department.

20. In the harbor at Key West, besides the docks belonging to the naval station, there are wharves belonging to and in use by the Mallory Steamship Co., the Peninsular & Occidental Steamship Co., and the Florida East Coast Railroad Co. The wharf of the Florida East Coast Railroad Co. is the only one which has direct physical connection with a railroad. In addition to the above wharves there are certain other wharves owned by private individuals that are used to a greater or less extent. The existing terminals are believed to be

ample at the present time for the port. The location of the various wharves is indicated on accompanying map.

21. There are no other subjects which can be properly considered in connection with the improvement under consideration.

22. It is recommended that a survey be made and plans be prepared.

J. R. SLATTERY,
Major, Corps of Engineers.

[First indorsement.]

OFFICE OF DIVISION ENGINEER,
SOUTHEAST DIVISION,
May 2, 1913.

To the CHIEF OF ENGINEERS:

1. I agree with the district officer that the local commerce of Key West is not sufficient of itself to warrant the construction of an expensive harbor of refuge for the safe anchorage of vessels, and I don't believe that the great number of ships passing this harbor would take advantage of or use a harbor of refuge if one existed there. A good steamer in time of storm would rather keep away from the shore and continue its course to or from the Gulf, giving a wide berth to the shoals among the Florida Keys and accepting the risk of damage from the waves rather than that of shoal water, so that I don't think passing vessels need a harbor of refuge here.

2. Whether a sheltered harbor here is needed for the amaller class of naval vessels is a question which ought properly to be considered and determined by the proper officials of the Navy Department, and it would seem that the treatment then should be such as is given to a naval station, and the matter ought not to be considered in a river and harbor bill.

3. In my opinion, the plan of providing a harbor of refuge and safe anchorage for vessels at Key West is not worthy of being undertaken by the United States at this time, and I would not recommend that any survey for it be made.

DAN C. KINGMAN,
Colonel, Corps of Engineers.

[Third indorsement.]

THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
May 26, 1913.

To the CHIEF OF ENGINEERS, UNITED STATES ARMY:

1. This is a report on preliminary examination of Key West, Fla., for a harbor of refuge and a safe anchorage for vessels. It seems clear from the facts presented that there is not sufficient need or demand for a harbor of refuge and a safe anchorage in the interests of general commerce and navigation to justify the United States in undertaking such an improvement, and it does not seem necessary or advisable to incur the expense of a survey and the preparation of plans and estimates with this end in view.

2. It appears, however, that some improvement here is desired by the Navy Department for the shelter of its small vessels. It is not clear whether the War Department would be justified in making a survey exclusively in the interests of the Navy Department from

funds appropriated under the river and harbor act in the absence of specific authority for such investigation. If an allotment can properly be made for this purpose, the board recommends that a survey be authorized to determine the extent and cost of the work desired by the Navy Department.

For the board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

MEMORANDUM BY CAPT. HAYDEN, UNITED STATES NAVY, COMMANDANT.

UNITED STATES NAVAL STATION, KEY WEST, FLA.,
March 24, 1913.

THE NEEDS OF THE NAVAL STATION AT KEY WEST.

1. It seems advisable, in view of the brief visit to the naval station of the House Naval Committee to-morrow, to present to them, as concisely as possible, the most important improvements needed in order to conform to the plans of the department, which are, as frequently stated in official reports, to make Key West an important secondary supply and torpedo-boat base to the principal battleship base at Guantamo Bay.

2. From this point of view, the most vitally important improvement is to provide a large inclosed basin in front of the station, in which such craft as gunboats, destroyers, and submarines can find shelter from heavy weather while undergoing repair and refitting.

3. Such a plan as the one recently before Congress, and of which blueprints are available, seems to answer the purpose very well, not only for the Navy, but for the Army, Lighthouse Establishment, marine hospital, and Weather Bureau, all of which now occupy land abutting on it, or, in the case of the Lighthouse Establishment, could easily arrange to do so, at the same time abandoning their present site in favor of the Navy, and thus making the naval station continuous instead of divided.

4. But in spite of the advantages of this or other inclosed basin, it is not sufficient in itself to protect the numerous, very expensive, important, and delicate naval vessels that might be there in a hurricane, nor does it assist the shipping of Key West, which is in vital need of suitable breakwaters—such, for instance, as one projecting southwesterly from Fort Taylor to the end of Whitehead Spit, and continued again, beyond the channel, in a westerly and northerly direction on Kingfish Shoal, and finally easterly on the Middle Ground and Frankford Bank.

5. With such inclosed basin for the Navy and breakwaters for both the Navy and Key West Harbor, the usefulness of the port, both strategically and commercially will be vastly increased, and other big improvements will soon follow as a matter of course—such as the deepening of the entrance channel and various anchorages, and the straightening and deepening of the important Northwest Channel, leading by a short cut from the Atlantic to the Gulf via Key West.

6. The remarkable and unique location of Key West, its naval command of the Straits of Florida and the Yucatan Channel and thus of the entire Gulf of Mexico, its commercial and trade importance as the nearest railway terminal to all of the West Indies and Central and South America, all combine to make its future importance such an absolute certainty that immediate action to build the proposed inclosed naval basin and breakwater would seem to be imperative.

7. Other important naval improvements that might well be carried out at once, or as soon as practicable, are the following:

8. Complete the large new storehouse, which is in need of an elevator and wire-mesh partitions and shelves for the proper stowage of stores.

9. Complete the new concrete coal sheds by adding the necessary machinery for handling the coal and delivering it to ships or coal barges.

10. Build a central power plant and a new and larger distilling plant in connection with it, all machinery to be operated by electric power.

11. Fit the marine railway with an auxiliary cradle, so that 300-foot destroyers can be docked and repaired safely.

12. Build new woodworking and paint shops and a boathouse and landing.

13. Build new marine barracks, capable of housing a large force in readiness for quick service.

14. Build quarters in the station for all officers likely to be on duty there. These quarters and all other buildings should be of fireproof construction.

15. Provide for the acquisition and addition to the naval station of the present city post-office and customhouse building, for which a new site has already been provided by Congress, and of the present lighthouse wharf, crowded in between Naval Piers A and B. The present public building is admirably adapted for an administration building for the naval station. With these two acquisitions the naval station territory will be continuous and can be fenced in and properly controlled and guarded.

16. Prepare plans for the location of all additional fuel-oil and gasoline tanks at Fleming Key and the eventual concentration of all such inflammable materials at that point, away from the station and city and fortifications which, of course, would draw an enemy's fire.

17. Improve the target range at Woman Key; build a landing and storehouse, and make it available for the enlisted men and maines of the station, the Naval Militia and National Guard of Key West, and the crews of visiting vessels of the Navy and Revenue Marine.

18. Begin at once to base flotillas of destroyers, submarines, and torpedo boats at Key West, in order that the young officers of the Navy may become familiar with the great network of reefs, shoals, channels, and keys that comprise the Florida Reefs, and their currents, tides, and storms, so that their dangers to an enemy may become our own best defense.

19. Establish aviation camps at Key Largo, Key West, and the Tortugas, for practice in cooperation with the fleet, or at least with destroyers and submarines, in the defense of the line of rail communication, the naval base itself, the Straits of Florida, and the Yucatan channel.

20. It is very likely that our next great naval battle will be fought in these waters about Key West or between Key West and the Panama Canal. That battle is going to convert about half a billion dollars' worth of dreadnaughts into junk and make the loser sue for peace at any cost of treasure, territory, and prestige. The efficiency of this naval base at Key West may determine the result of that battle.

SURVEY OF KEY WEST HARBOR, FLA.

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
Jacksonville, Fla., October 9, 1913.

From: The District Engineer Officer.

To: The Chief of Engineers, United States Army.

Subject: Survey of Key West Harbor, Fla.

1. In compliance with department letter dated June 4, 1913, the following report on the survey of Key West Harbor is submitted, together with plans for the construction there of a harbor of refuge.

2. As comparatively recent maps of the harbor were available, the survey work was limited to taking borings along the lines of the proposed breakwaters and to examining rock deposits in the vicinity of Key West.

3. The island of Key West and the shoal banks on the north and west of the harbor form almost perfect protection to the harbor from wave action due to the northerly and easterly storms, and considerable protection against wave action from westerly storms. The harbor is somewhat exposed to wave action from waves formed in the north-west channel and is very much exposed to wave action from southerly storms. In order to insure, under all weather conditions, safe anchorage for such boats as torpedo boats and torpedo-boat destroyers, breakwaters would, it is believed, be necessary to protect the harbor from wave action from the south and west. The system of breakwaters believed to be necessary for this purpose is indicated on

the map. So far as hurricanes are concerned, the arm D could probably be safely omitted, but its absence might be felt by small boats in lesser storms. The arm D and the inner end of arm C would be exposed to much lighter wave action than the outer end of the arm C and the arms A and B, and could therefore be made of lighter section. The wave action to which the latter would be exposed is limited by the numerous shoals and banks lying to the south of the harbor, and it is estimated that the maximum wave height would not exceed 16 feet. Assuming this as the maximum wave height and assuming the width of the harbor entrance to be 500 feet, it is calculated from Stevenson's formula that the maximum wave height at the navy wharves would not under any conditions exceed 2.9 feet. While torpedo boats could not lie very comfortably alongside of wharves in waves of this height, they would not be actually damaged if they did so, and would be perfectly safe if they moved away from the wharf. Such wave heights would occur only during the most exceptional storms, and in all ordinary storms even torpedo boats would have no difficulty in lying alongside the wharves. The protection that would be afforded is therefore considered ample, and it is believed that it would be better not to further restrict the opening into the harbor in order to further reduce wave action. With an opening 600 feet wide the maximum wave would be 3.4 feet high, and with an opening 800 feet wide, 4.3 feet. With an opening 400 feet wide the maximum wave would be about 2.5 feet high.

4. The borings taken show that along the line of the proposed breakwaters for almost their entire length the rock is entirely bare or overlaid with only a very thin layer of sand and shell. The foundations are, therefore, excellent, and but little rock would be lost by settlement in the sand. At the northern end of arm D, the thickness of the layer of soft material overlying the rock becomes much greater, but this condition prevails for only a relative short distance, and occurs in the least exposed portion of the breakwater.

5. Coral or limestone conglomerate rock is found on many of the keys along the line of the Florida East Coast Railroad. The most workable supplies were found on Cudjoes Key, Big Pine Key, and Windlys Key, the latter belonging to the Florida East Coast Railroad. The former is accessible both by rail and water, the two latter by rail only. This rock is light, weighing not more than 105 pounds to the cubic foot, but would, it is believed, do for the core of a breakwater. According to railroad inquiries, 50 per cent of it is pulverized in blasting operations, but good sized pieces can be gotten out by channeling. The cost of the channeled rock is, according to the same authority, about \$1.50 per cubic yard.

6. Breakwaters of the rubble mound type, with coral base and core and granite capping would, it is believed, be best adapted for this work. Two cross sections, as shown on map, are proposed—one for arms A and B, and for C for a distance of 3,000 feet from its intersection with arm B, and the other for the remainder of C and for arm D. The proposed base is brought to a plane 12 feet below mean low water, and is composed of coral rock, being placed on the seaward slope. The base is proposed to be capped with granite rock, weighing from 5 tons up in the heavier section, and weighing from 2 tons up in the lighter section.

7. The cross sections show the slopes which it is estimated the rock would take. On this assumption, the estimated cost of the work becomes:

Arms A, B, C, and D:

348,500 tons of coral rock, at \$2.....	\$697, 000
356,250 tons of hard rock, at \$3.50.....	1, 246, 875

	1, 943, 875
Engineering and contingencies, 10 per cent.....	194, 387

Total.....	2, 138, 262
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If the arm D were omitted, this estimate would become arms A, B, and C:

255,000 tons coral rock, at \$2.....	\$510, 000
257,000 tons hard rock, at \$3.50.....	899, 500

	1, 409, 500
Engineering and contingencies.....	140, 950

Total.....	1, 550, 450
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8. The map also shows the basin originally proposed by the Navy Department for the protection of smaller vessels. To carry out this plan vertical breakwaters would be necessary. It is believed that breakwaters of the caisson type, as shown on map, would be sufficient so far as protection of the inclosed area from wave action is concerned. The estimated cost of breakwaters of this type is as follows:

Reinforced concrete, 10,377 cubic yards, at \$20.....	\$207, 540
Plain concrete, 5,200 cubic yards, at \$10.....	52, 000
Filling caissons, 50,000 cubic yards, at 25 cents.....	12, 500

	272, 040
Engineering and contingencies, about 10 per cent.....	27, 960

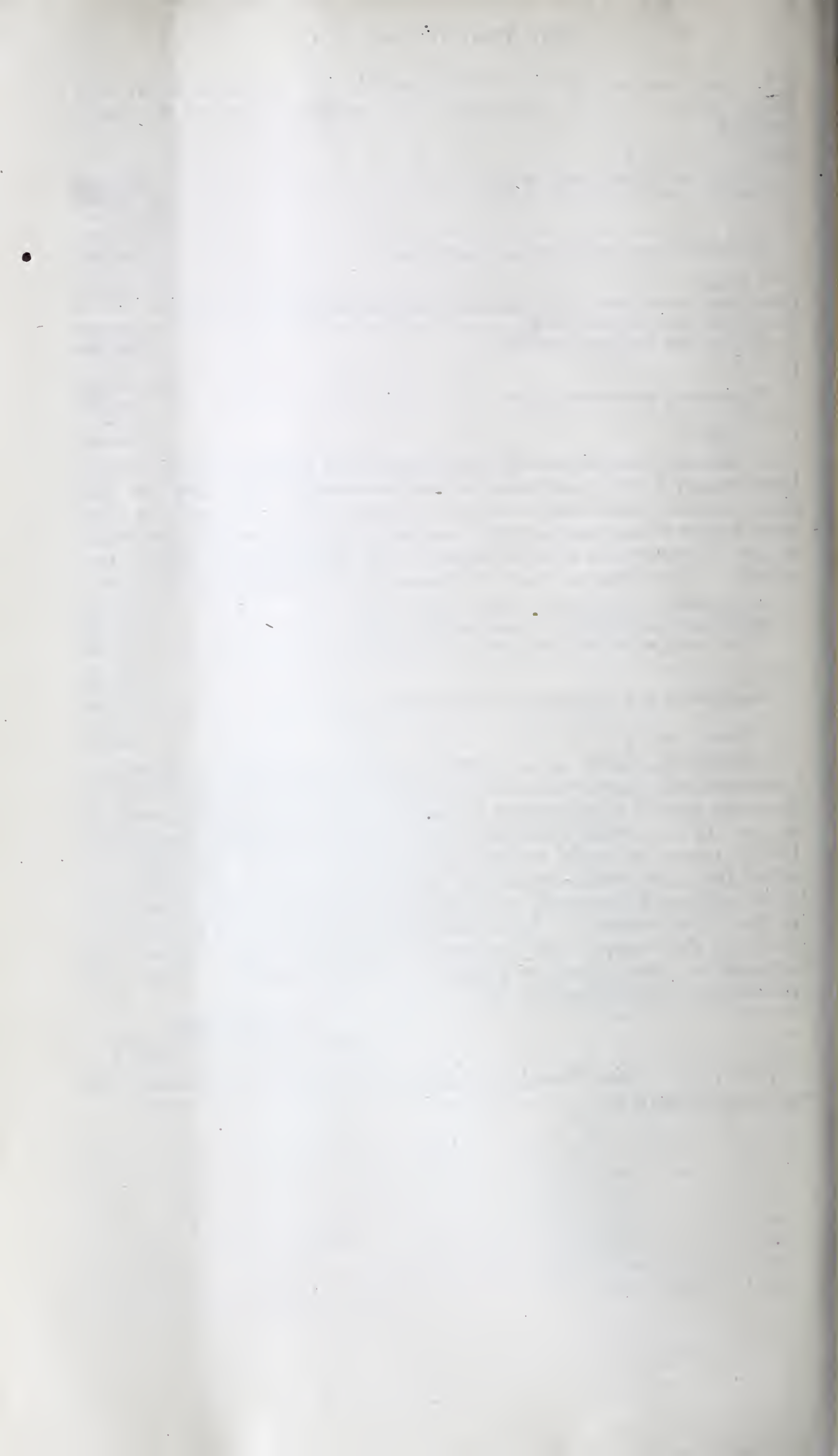
Total.....	300, 000
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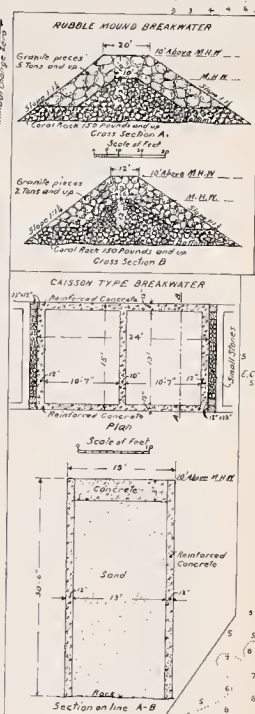
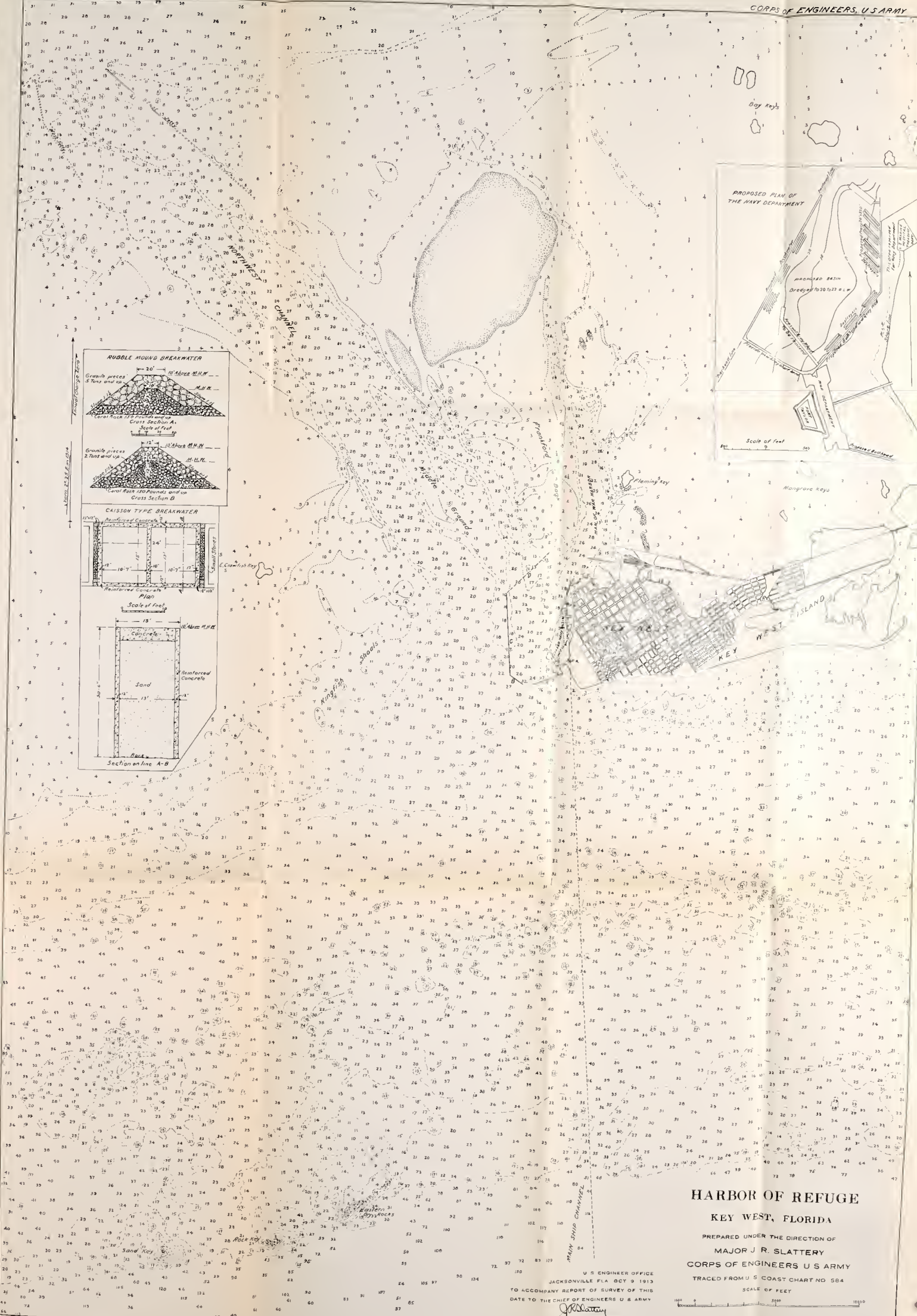
9. While the basin as proposed by the Navy makes no provision for general commerce and would be difficult to enter in bad weather, the extra cost of constructing breakwater such as would be necessary to provide for general commerce and to insure reasonably easy access during storms, as herein outlined, is not believed to be warranted by either the commercial or military importance of Key West, and the larger scheme is, therefore, not considered worthy of being undertaken by the United States. The construction of a basin such as that proposed by the Navy would appear to be purely a Navy matter, and it, therefore, does not seem proper for the undersigned to make any recommendation in regard to it.

J. R. SLATTERY,
Major, Corps of Engineers.

[For report of the Board of Engineers for Rivers and Harbors on survey see page 3.]







HARBOR OF REFUGE KEY WEST, FLORIDA

PREPARED UNDER THE DIRECTION OF
MAJOR J. R. SLATTERY
CORPS OF ENGINEERS U.S. ARMY
TRACED FROM U.S. COAST CHART NO. 584

SCALE OF FEET
0 100 200 300 400 500 600 700 800 900 1000

U.S. ENGINEER OFFICE
JACKSONVILLE, FLA., OCT. 9, 1913
TO ACCOMPANY REPORT OF SURVEY OF THIS
DATE TO THE CHIEF OF ENGINEERS U.S. ARMY
J. R. Slattery
MAJOR CORPS OF ENGINEERS U.S. ARMY

